themselves to a qualification test, is in order that these offices may not be the refuge for genteel incompetence, but may be bestowed on the most fitting aspirant. We fear the above facts will show that the present system is not calculated in all cases to secure this end.

THE GIBRALTAR CURRENT

MR. CROLL having stated (NATURE, August 17) that, taking my own data, and having "in regard to the Gibraltar current and Dr. C.'s general oceanic circulation, determined the absolute amount of those effects on which his circulation depends," he has satisfied himself by mathematical investigation "that the work of the resistances greatly exceeds the work of gravity, and that consequently there can be no such circulation as that for which Dr. C. contends,"—I think it well to point out that the question of the existence of such a circulation is not to be disposed of by the calculations of even such an expert computer as Mr. Croll, but must be decided by the collection and comparison of facts ascertained by observation and experiment.

Now, as it happens that an opportunity has been recently afforded me by the Hydrographer to the Admiralty of carrying out, in conjunction with Captain Nares, of H.M.S. *Shearwater*, a series of further researches on the Gibraltar current, which place beyond all doubt the outflow of dense Mediterranean water into the Atlantic, over the "ridge" or "marine watershed" between Capes Trafalgar and Spartel, and beneath the surface-inflow of Atlantic water, I would submit (1) whether there must not be some fundamental fallacy in Mr. Croll's computations in regard to the Gibraltar current, and (2) whether this fallacy should not destroy all confidence in the infallibility with which Mr. Croll credits himself in regard to the general oceanic circulation.

No one can be more ready than myself to admit that this last doctrine is at present only a hypothesis, resting on a very narrow basis of fact. But as this hypothesis has been accepted as probable by such great masters in physical science as Sir John Herschel and Sir William Thomson, and as the means of putting it to the test will be supplied by the Scientific Circumnavigation Expedition, which (I have every reason to expect) will be fitted out by Her Majesty's Government next year, I would venture to suggest whether prudence does not dictate to the opponents of that doctrine, that they should either drop further discussion of it for the present, or that at any rate they should refrain from attempting to demonstrate its impossibility.

The number of NATURE which contained Mr. Croll's letter, having also given an account of the discussion which took place in the Physical Section of the British Association on a communication I made to it with reference to this subject, I may mention that my especial purpose in that communication was to obtain the judgment of the able physicists there assembled, as to a fundamental question at issue between my friend, Prof. Wyville Thomson, and myself, namely, the *cause* of that flow of polar water over the deepest parts of the ocean bottom, bringing down its temperature even under the equator to 33°·5, as to the fact of which we are in entire agreement. By my excellent colleague it is considered* that this flow is due to an indraught of polar water, occasioned by the surface efflux of equatorial water resulting from the action of the Trade Winds. To myself (not professing more than an elementary knowledge of physics) it seemed probable, on the principle of "least action," that the surface-water so removed would be replaced by an inflow from some other part of the oceanic surface, that is, by a horizontal circulation, rather than by an uprising of the whole subjacent mass, so as to draw in polar water at the bottom, and I have pointed out that such a surface-replacement is known to take place in the case of the Gulf Stream, one portion of which directly returns into the equatorial current, completing the shorter circulation, whilst the other has its complement in the Greenland, Labrador, and other polar surface-currents, of which the principal is traceable southwards nearly as far as the exit of the Gulf Stream from the Narrows, thus completing the longer circulation.

The correctness of this "common-sense" judgment was most emphatically affirmed, on the basis of profound physical knowledge, by Sir William Thomson and Prof. Stokes. It was agreed by these high authorities that in the open ocean the action of wind on the surface can never produce any other than a surface movement; the water propelled onwards from one part of the oceanic area being replaced by a surface inflow from other parts It is, therefore, for my opponents to explain how, otherwise than by gravity, it happens that polar water finds itself at the depth of 2,000 fathoms under the equator. That the bottom-temperature of the equatorial area, if there were no movement of polar water towards the equator, would be at least 20° higher than it is, may be asserted without the least hesitation; the temperature of the Mediterranean, which is cut off from communication with the lower stratum of the Atlantic, being 54° at corresponding depths.

It was agreed by Sir William Thomson and Prof. Stokes, that when a wind blows continuously into a loch or fiord, so as to produce a rise of water at its head to the amount of 6, 8, or 10 feet, such an excess or vertical pressure produces an outward under-current; the evidence of such outflow being afforded by the continuance of the surface in-current at the rate of three or four miles per hour, without any further increase in the rise of water at the head of the loch. This exceptional case was advanced by Sir W. Thomson as strongly confirming my general principle, not as invalidating it; and I would therefore recommend Mr. Croll to test his method of investigation by this ascertained fact, rather than spend his time in demonstrating the impossibility of what he may hereafter have to admit as no less certainly proved.

WILLIAM B. CARPENTER

H.M.S. *Shearwater*, Malta,
Sept. 20

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[*] See his Address on "The Distribution of Temperature in the North Atlantic," NATURE, July 27.

SCIENCE IN ITALY

IN NATURE for June 8, I sketched a short notice of some of the Italian scientific serials, among them the *Annali di Chimica Applicata alla Medicina*, published at Milan. With the commencement of the present year the *Gazetta Chimica Italiana* has been launched at Palermo. The project of this publication originated in Florence with a society of Italian chemists, who met there in October last, and resolved to entrust the first year's "direction" of the magazine to Prof. Stanilaus Cannizzaro of the University of Palermo.

The Italian Chemical Gazette very nearly resembles the *Journal of the Chemical Society of London*. Like this it contains, first, original memoirs; second, translations or abstracts of the most important foreign chemical memoirs; third, a review of technological chemistry, agricultural chemistry, and crystallography; fourth, a summary of the principal chemical journals of Germany, England, and France; fifth, miscellaneous notes that may be interesting to those who cultivate chemical science. It is published monthly.

The most prominent, the longest, and most interesting of the original papers is by Prof. Cannizzaro: "Historical notes and reflections on the Application of the Atomic Theory to Chemistry, and on the Systems of Formulæ for expressing the Constitution of Compounds." This paper is continued in the number for January, April, and May,

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and is not yet completed. The following extract from the introductory observations will indicate the spirit in which it is written :—"A few are still dissatisfied with the arguments against the dualistic system, and continue to employ the atomic weights of Berzelius, or the equivalents of Gmelin ; and among those who have adopted the new system of atomic weights and formulæ, there are many who have done so merely in a spirit of concession, and make a display of scepticism respecting its intrinsic value ; others, on the contrary, push their faith to the extent of fanaticism, and give equal value to the essential and accessory parts of the system, or even cling to hypotheses that merely lean against it or have been discarded. They often speak on molecular subjects with as much dogmatic assurance as though they had actually realised the ingenious fiction of Laplace—had constructed a microscope by which they could detect the molecules, and observe the number, form, and arrangement of their constituent atoms, and even determine the direction and intensity of their mutual actions. These things, which have been offered merely as hypotheses more or less probable, and to be taken for what they are worth as simple artifices of the intellect, are valuable, and have done good service in collocating facts and inciting to further careful investigations that one day or other may lead to a true chemical theory ; but when perverted by being stated as actual truths, they falsify the intellectual education of students of inductive science, and bring reproach upon the modern progress of chemical science."

We learned a great deal from Italy in the Middle Ages, and may yet learn more. I earnestly commend the above lesson to some of our laboratory aspirants, who are occupying themselves in ringing the changes upon organic compounds, and who afterwards describe their atomic achievements as glibly, mechanically, and confidently, as though they had been laying bricks or piling shot.

An interesting paper (a note it is modestly called) on "The Absorbent Power of Red Phosphorus" is contributed to the May number, by Fausto Sestini, from the Laboratory of the Royal Technical Institute of Udine. (Udine is a small town, smaller than Croydon, and situated about 70 miles N.E. of Venice. How many of such towns in England have Royal Technical Institutes with laboratories for original research ?) The author finds that red phosphorus absorbs many substances without combining with them, after the manner of porous charcoal. Thus it may be made to take up 3·369 per cent. of iodine, a considerable quantity of sulphur, rosaniline, &c. This power of "chemical adhesion" may be easily and strikingly shown by shaking powdered red phosphorus in a test tube containing a coloured solution of iodine in bisulphide of carbon. When a sufficient quantity of phosphorus is used, the whole of the iodine is taken up and the solvent rendered colourless. Rosaline is similarly removed from an etherial solution, and a portion of it may be again recovered unaltered from the phosphorus by washing with alcohol.

The July number contains some further contributions by Sestini from the same laboratory, on the proportions of bisulphide of carbon, its solubility in water, and the compounds formed by its contact with aqueous solutions of the oxides of the metals of the alkaline earths. Also some interesting communications from the laboratory of the University of Siena by Prof. G. Campani, among which is one showing that the absorption bands of an ammoniacal solution of carmine so closely coincide with those of blood, as to be undistinguishable in a spectroscope with a scale of twenty degrees. Mr. Sorby will probably be able to tell us whether any difference is distinguishable by more minute examination.

Lieben and Rossi contribute a series of rather important papers on some of the alcohols, and besides these there are some of the ordinary miscellaneous contributions to organic chemistry. W. MATTIEU WILLIAMS

THE CRYSTAL PALACE AQUARIUM

IN NATURE of April 20 last appeared a short paragraph, stating that this "enterprise, of which great scientific use can certainly be made," was taking form, and that when some of the marine animals were introduced, and the thing was in working order, a description of it would be given.

The building undertaken by the Crystal Palace Aquarium Company was commenced in July 1870, much too late therefore to be opened when at first contemplated, April 1, 1871, though at Easter last half a dozen of the marine tanks were temporarily converted into freshwater ones, and some pike, tench, carp, eels, &c., were shown therein for three days ; when the place was closed, and the progress of the works continued, and then the establishment was finally opened on August 22, 1871. It would have been well if the sea-water had been in good condition in the early part of the summer, so that advantage might have been taken of the then exceptionally cool weather to transport some of the great abundance of animals at that time on the coasts of England ; but that was not possible, and then, when the water *was* fit, the weather became very hot, and the sending of many animals was thereby prevented. Such creatures as could be got, however, were obtained, and the opportunity is now being taken of the present increasingly colder season to add other animals constantly, so that in a short time most of the tanks will be populated.

The accompanying plan, on page 471, drawn to a scale of about 50 ft. to 1 in., shows the ground occupied by the Aquarium and its adjuncts to be nearly 400ft. long and 70ft. broad, and it is situated at the northern end of the Palace, on a portion of the site of it burnt in 1865. It is of one story high, and, therefore, this ground plan shows everything, except the sea-water reservoir beneath the Saloon G G, extending under its whole width, and running below Tanks 9 and 10, and going lengthwise from E to H2. This reservoir contains 80,000 gallons of sea-water, and the tanks above contain 20,000 gallons, in all 100,000, gallons weighing a million pounds ; and the fact of the aggregate contents of the tanks being only one-fourth of the contents of the reservoir, is extremely serviceable in keeping the water clear, as, supposing the water in, say tank 10 (holding 4,000 gallons), became turbid from any cause, it can be emptied by syphons in less than an hour into the reservoir, where so comparatively small a quantity of fluid would not appreciably disturb the purity of so great a mass, from which, in less than half an hour, No. 10 can again be filled, and thus all the tanks where animals exist, are, by being constantly pumped into, day and night, from the large, clear, and cool reservoir below, where there are no creatures, kept ever in good order. The main aëration which is thus depended on for the health of the creatures, is by these means produced by mechanical agitation, and the quantity of sea-weed necessary to decompose the poisonous carbonic acid gas evolved from the animals, which could not be effected by mechanical agitation, is grown upon the rocks of the aquarium by the action of light on the spores of algæ existing invisibly in the water. As the motion of the water needs to be incessant, all the machinery is in duplicate, there being two boilers, each of four horse power, two steam-engines, each of three horse power, and two of Forbes's patent pumps, and one of each is kept ever in action, the other being in reserve in case of accident. The sea-water issuing from the pumps at the rate (indicated by a counter, while a tell-tale clock furnishes evidence of the attention of three enginemen, each working for eight consecutive hours) of from 5,000 to 7,000 gallons an hour, passes in the first place into the two highest tanks, 9 and 10, half into each, and from thence it runs, diverging north and south, as far as tanks 18 and 1. From 18 it flows into 60, and from 1 into 39, in each case passing

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